

AL-1.148

Report D90-A


CANADIANA

l2
FEB 12 1990



Hydro Power Plant Dickson Dam

January 1990



Digitized by the Internet Archive
in 2015

<https://archive.org/details/hyrdopowerplantdickson90>



Hydro Power Plant Dickson Dam

Decision Respecting Competing Applications By:

**Canadian Hydro Developers, Inc.
Independent Producer Power, Inc.
Dickson Power Ltd.
The Special Areas Board**

January 1990

ENERGY RESOURCES CONSERVATION BOARD

APPLICATIONS NO. 881550

881838

881989

890529

January 1990

Published by:

Energy Resources Conservation Board

640 Fifth Avenue SW

Calgary, Alberta

T2P 3G4

Telephone (403) 297-8311

PRICE: \$10.00

CONTENTS

	Page
1 APPLICATIONS AND HEARING	1
1.1 Background	5
1.2 The Small Power Research and Development Program	5
1.3 The Dickson Dam Facility	6
2 PRELIMINARY MATTERS	6
2.1 Legal Capacity of The Special Areas Board to Make Application to the ERCB	6
3 DESCRIPTION OF THE PROPOSED PLANTS	7
3.1 Canadian Hydro Developers, Inc.	7
3.2 Independent Producer Power, Inc.	12
3.3 Dickson Power Ltd.	14
3.4 The Special Areas Board	18
4 ISSUES RAISED AT THE HEARING	20
4.1 Technical Matters	20
4.2 Connection with TransAlta Utilities Corporation	22
4.3 Total Project Cost Estimates	26
4.4 Energy Production	29
4.5 Optimum Size and Economic Viability	31
4.6 Proponents' Abilities to Finance and Complete Project	34
4.7 Consistency with the Small Power Research and Development Act	36
4.8 Other Matters	37
5 CRITERIA AND SELECTION OF THE PROJECT FOR APPROVAL	39
5.1 Criteria	39
5.2 Selection of the Project for Approval	43
6 FINDINGS AND CONCLUSIONS	48
7 DECISION	49

 FIGURES AND TABLES

	Page
Figures	
1 Dickson Dam Location Plan	3
2 General Layout of Proposed Plants	9
3 General Layout of Proposed Plant	15
4 Alternative Connection Schemes - Dickson Dam	23

Tables	
1 Those Who Appeared at the Hearing	1
2 Estimates of Interconnection Costs	22
3 Project Costs as Estimated by Applicants	27
4 Estimates of Annual Energy Production	30
5 Dickson Dam Power Project - Case Comparison	43

1 APPLICATIONS AND HEARING

The Energy Resources Conservation Board (ERCB) received competing applications, pursuant to sections 9 and 17 of the Hydro and Electric Energy Act and to the Small Power Research and Development Act, for approval to install a small hydro power plant at the Dickson Dam, from the following:

1. Canadian Hydro Developers, Inc.
2. Independent Producer Power, Inc.
3. Dickson Power Ltd.
4. The Special Areas Board

The Dickson Dam is located about 24 kilometres (km) west of Innisfail, Alberta, as shown in Figure 1.

The applications were considered concurrently at a public hearing in Calgary on 20, 21, 27, 28, and 29 June 1989, with G. J. DeSorcy, P.Eng., F. J. Mink, P.Eng., and J. P. Prince, Ph.D., sitting. Written final arguments were subsequently filed with the Board prior to 14 July 1989. To complete the proceeding, all four applicants were given opportunity to respond, by 21 July 1989, to arguments raised by other applicants.

TABLE 1 THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations Used in Report)

Witnesses

Canadian Hydro Developers, Inc.
(Canadian Hydro)
Ms. P. Smith, Q.C.

J. R. Keating, P.Eng.
J. D. Keating, C.A.
D. B. Chalcroft, P.Eng.
J. A. Knowles, P.Eng.
P. C. Roxburgh, P.Eng.

Independent Producer Power, Inc.
(Independent Producer)
J.E.E. Lowe

J. M. Lowe, P.Eng.
E. Anderson, P.Eng.
T. P. Taylor, P.Eng.
H. S. Williams, P.Eng.
M. D. Rogers, P.Eng.
C. Guillaud, P.Eng.
J. C. Shepard
G. K. Bowden

Dickson Power Ltd.
(Dickson Power)
A. MacWilliam

D. Main, P.Eng.
J. R. Breckon, P.Eng.
D. A. Peterson, P.Eng.
F. H. Schwartz

The Special Areas Board
(Special Areas Board)
G. A. Salembier

A. Grover
L. Gloin, P.Eng.
D. Roberts, P.Eng.
T. Waters, P.Eng.
M. Vanderburgh, P.Eng.
P. Levelton
P. Fenwick

TABLE 1 THOSE WHO APPEARED AT THE HEARING (cont'd)

Principals and Representatives (Abbreviations Used in Report)	Witnesses
TransAlta Utilities Corporation (TransAlta) D. M. Todesco	G. M. Steeves, P.Eng. N. J. Brausen, P.Eng. R. A. Stout, P.Eng.
Alberta Power Limited (Alberta Power) J. Walker, P.Eng. B. Laing, P.Eng.	
Department of the Environment (Alberta Environment) S. A. Franklin	
Ducks Unlimited Canada (Ducks Unlimited) J. Brunen	J. Brunen
Prairie Association for Water Management (Prairie Association) H. Gordon	B. Lockhart
Energy Resources Conservation Board staff M. J. Bruni M. L. Asgar-Deen, P.Eng. S. S. Lota, P.Eng. A. S. Kwaczek P. Wickel	

The following parties filed submissions but did not appear at the hearing:

County of Red Deer
County of Paintearth No. 18
Special Areas Board No. 2
Big Country Fish & Game Association
Town of Castor
Town of Oyen
Municipal District of Acadia No. 34
Agricultural Service Board No. 3
Municipal District of Starland No. 47
W. Douglas Fawcett
J. Klobberdanz
Big Country Agricultural Society

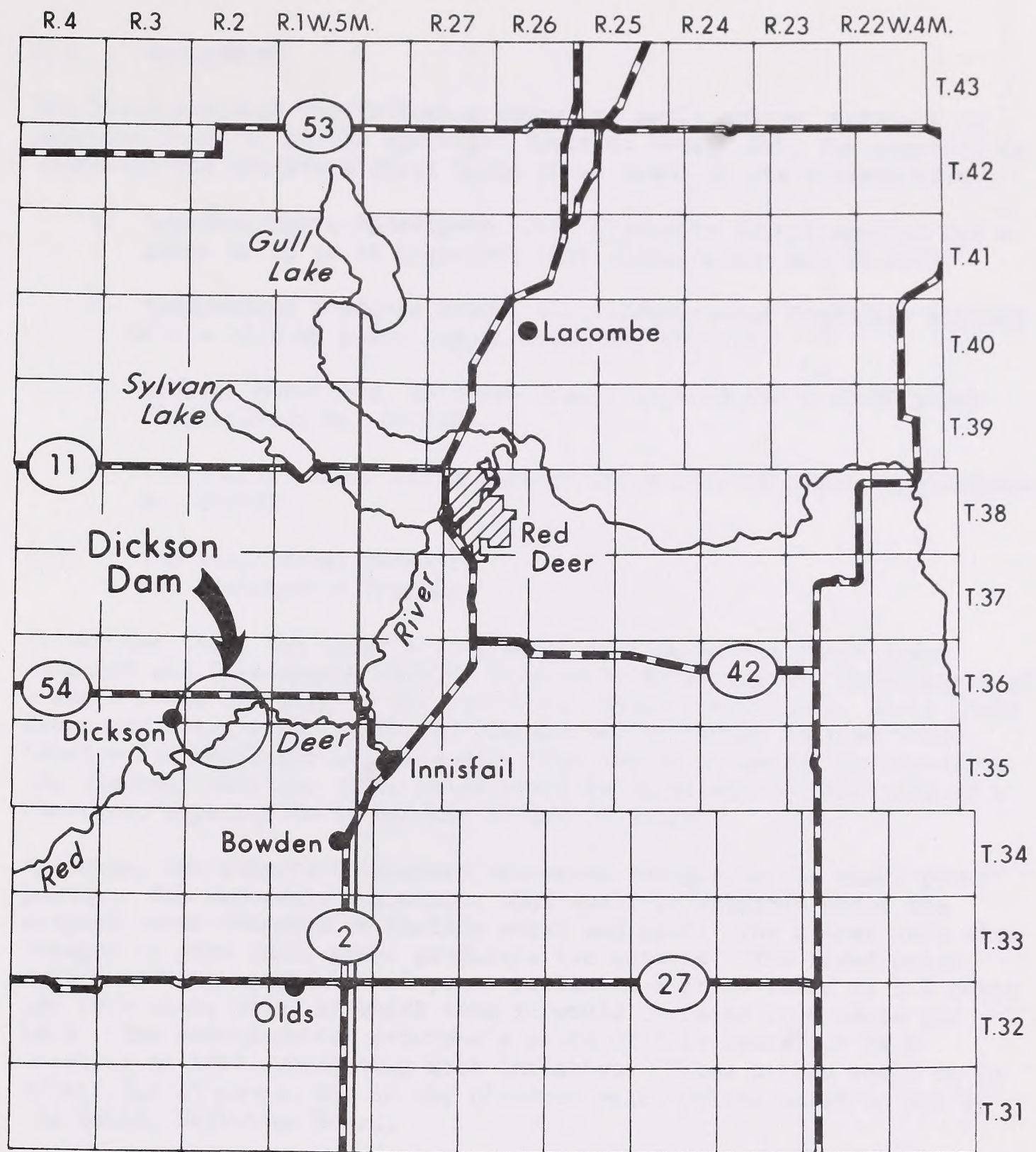


FIGURE 1: DICKSON DAM LOCATION PLAN
 Applications No. 881550, 881838, 881989, 890529
 Dickson Dam Power Plant

U.S. GEOLOGICAL SURVEY WATER RESOURCES DIVISION



FIGURE 1. GLEN CANYON DAM LOCATION PLAN
 (Continued on next page)

1.1 Background

The Board received the following competing applications, pursuant to sections 9 and 17 of the Hydro and Electric Energy Act, for approval to construct and operate a small hydro power plant at the Dickson Dam:

1. Canadian Hydro Developers, Inc. (Canadian Hydro) applied for a plant of up to 10 megawatts (MW) (Application No. 881550).
2. Independent Producer Power, Inc. (Independent Producer) applied for a 12.8-MW plant (Application No. 881838).
3. Dickson Power Ltd. (Dickson Power) applied for a 10-MW plant (Application No. 881989).
4. The Special Areas Board applied for a 14.9-MW plant (Application No. 890529).

1.2 The Small Power Research and Development Program

In October 1988, the Alberta Government introduced the Small Power Research and Development (SPR&D) Program to encourage the development of a small power industry in the province. Under the program, small power producers using wind, water, or biomass as the energy sources would receive 5.2 cents for each kilowatt-hour (kW.h) of energy delivered to the electric utility. This price would be in effect for the term of a contract, expected to be between 10 and 20 years.

Recently, the Alberta Government announced changes to the small power policy. The renewable resources, that would be eligible under the program, were extended to include solar and peat. The prices were also changed to give small power producers two options. The fixed price option would guarantee small power producers a price fixed at 5.2 cents per kW.h until 1995, at which time it would increase to 6 cents per kW.h. The second option provides a price of 4.64 cents per kW.h starting in 1990, escalating with inflation. These prices would be in effect for 10 years, and in the eleventh year, prices would be set by the Public Utilities Board.

Section 4(1) of the SPR&D Act directs that

"Where the Energy Resources Conservation Board is considering an application under section 7, 8, 9, or 17 of the Hydro and Electric Energy Act in respect of an eligible power production facility for which an application for an allocation of capacity under this Act has been made to the Minister, the Board shall not have regard to whether the facility is an economic source of electric energy in Alberta or to whether there is a need for such a facility in meeting the requirements for electric energy in Alberta."

All four applicants have obtained preliminary allocation of capacity under the SPR&D Program from the Department of Transportation and Utilities, which administers the program. Therefore, the question of the need for the facility and whether it is the least-cost option to supply power to the Alberta Interconnected System (AIS) were matters outside the purview of the hearing.

1.3 The Dickson Dam Facility

The Dickson Dam, owned and operated by Alberta Environment, is located about 24 km west of Innisfail on the Red Deer River. The dam, completed in 1983, was built to assure a minimum seasonal regulated flow and to improve the quality of water downstream of the dam. Construction of the dam provided for the future addition of a power plant. Alberta Environment has stipulated how this plant would be integrated into the existing dam and its operations.

2 PRELIMINARY MATTERS

2.1 Legal Capacity of Special Areas Board to Make Application to the ERCB

2.1.1 Views of Independent Producer Power, Inc.

At the outset of the hearing, Independent Producer expressed concern regarding the Special Areas Board's legal capacity to make Application No. 890529 to the ERCB. It stated that section 21 of the Hydro and Electric Energy Act allows corporations created by an act of the legislature to apply to the ERCB only if the enabling legislation has empowered that corporation to engage in the business of generating or transmitting electricity. Independent Producer argued that the Special Areas Act does not even remotely empower the Special Areas Board to engage in such business.

Independent Producer noted that the Special Areas Board, as an agent of the Crown by virtue of section 27(2) of the Special Areas Act, does not require ERCB approval but could proceed directly to enter into negotiations with the owner of the dam to start construction of the hydroelectric project. However, instead, it is inappropriately applying to the ERCB as a corporation under the Hydro and Electric Energy Act.

Independent Producer acknowledged that Ministerial Order No. 251/89, issued by the Minister of Municipal Affairs, authorized the Special Areas Board to apply to construct a power plant at Dickson Dam, and to take the necessary steps to construct the plant. However, it raised doubts as to whether that delegation of authority was proper and whether the Minister properly gave the Special Areas Board the standing required under the Hydro and Electric Energy Act.

In conclusion, Independent Producer submitted that, given the plain meaning of the wording of the Hydro and Electric Energy Act and the Special Areas Act, the ERCB should find that the Special Areas Board is not empowered to engage in the business of generating or transmitting electricity. Detailed examination of these, and several other Acts, would result in the same conclusion. Independent Producer, therefore, submitted that the ERCB should not hear the application of the Special Areas Board.

2.1.2 Views of Dickson Power Ltd.

Dickson Power supported Independent Producer's submission, urging the ERCB to disqualify the Special Areas Board from participation in this particular project.

2.1.3 Views of Canadian Hydro Developers, Inc.

Canadian Hydro did not make any submission regarding this matter but supported the positions taken by Independent Producer and Dickson Power.

2.1.4 Views of the Special Areas Board

The Special Areas Board submitted that the intent of the Special Areas Act is to ensure that the Special Areas Board has whatever authority the Minister of Municipal Affairs delegates to it. It argued that Ministerial Order No. 251/89 clearly shows that the Minister of Municipal Affairs has authorized the Special Areas Board to apply to the ERCB for approval to construct a power plant at Dickson Dam, the Minister is empowered to do whatever promotes the economy of the Special Areas, and the Dickson Dam development is in keeping with this objective.

2.1.5 Views of the Board

After considering the submissions of the participants, the Board concluded that, given the provisions of the Special Areas Act and Ministerial Order No. 251/89, the Special Areas Board is entitled to acquire an approval under the Hydro and Electric Energy Act. It therefore decided to consider the application of the Special Areas Board concurrently with the other three applications.

3 DESCRIPTION OF THE PROPOSED PLANTS

3.1 Canadian Hydro Developers, Inc.

Canadian Hydro proposed a reinforced concrete, steel-framed aluminum powerhouse located in the stilling basin downstream from the tunnel outlet, generally as shown in Figure 2. The building itself would have a removable roof to allow the use of a mobile crane for maintenance, although the powerhouse would not be equipped with a crane. Prior to construction, Tunnel No. 2 would be dewatered using a timber crib cofferdam. Canadian Hydro stated a project completion date of January 1991.

Canadian Hydro proposed installing two Kaplan-type turbines and two synchronous generators. Canadian Hydro would build a two-unit powerhouse but, initially, would install just one 6-MW unit. When the future operating conditions of the dam have been identified by Alberta Environment, a second 4-MW unit may be installed. Both units would be rated at 29-metre (m) head.

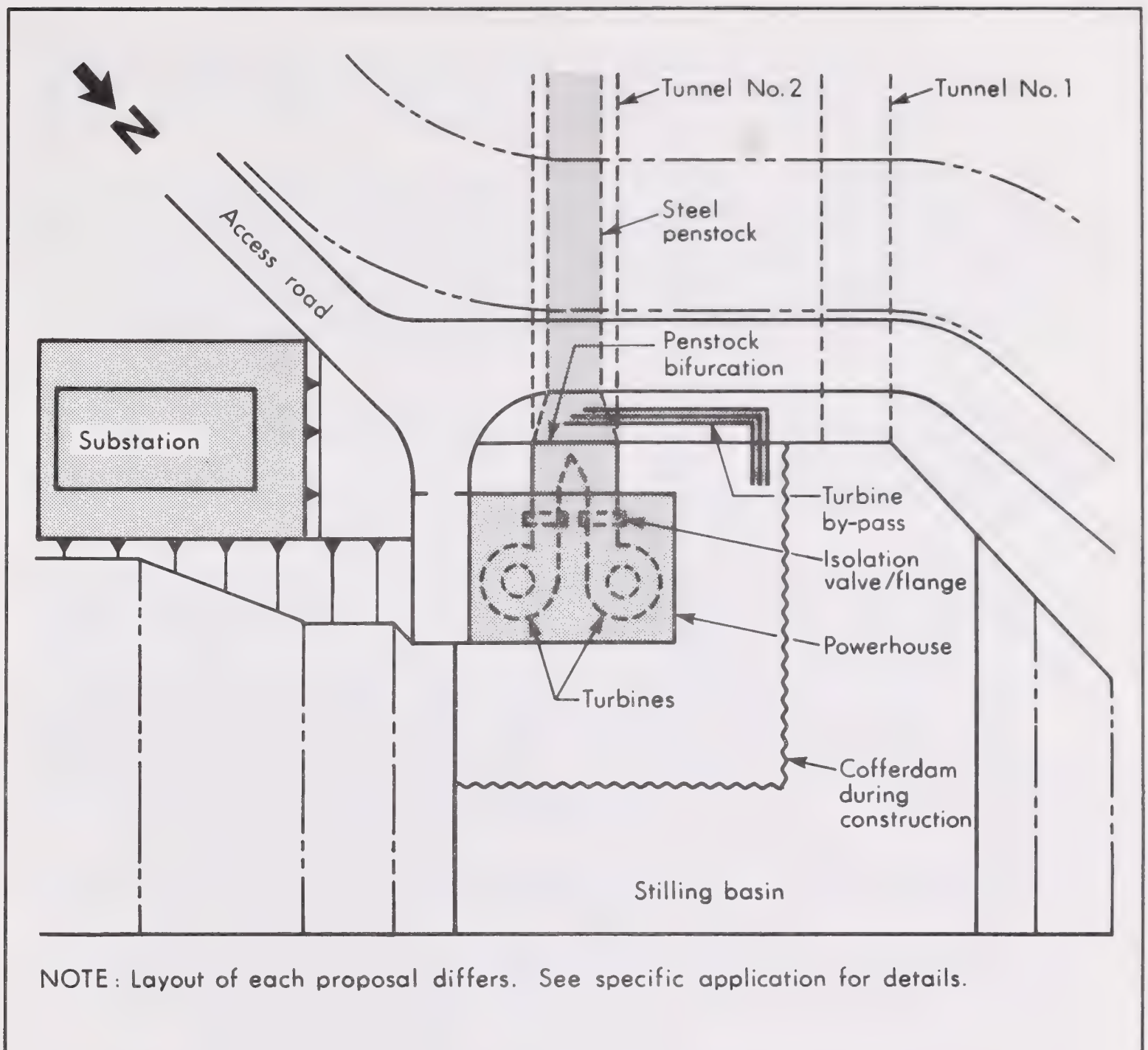
Canadian Hydro stated that its 10-MW phased approach would achieve an appropriate balance, avoiding undue waste of hydro resources while assuring economic viability. The phased approach would allow flexibility, as the second unit would not be installed until Alberta Environment's objectives were clear. Canadian Hydro stated that its commitment to develop the full project is indicated by its proposal to size the key facilities for a 10-MW installation. However, installing the entire 10 MW of capacity immediately would result in a project whose economic viability would be dependent on the continuation of existing flows, creating a potential conflict between the owner of the Dickson facility and the hydroelectric developer. The Canadian Hydro proposal avoids this possibility while preserving the opportunity to develop the site to its maximum economic potential if the present flows are maintained.

The penstock would be bifurcated at the powerhouse to supply each turbine. Each turbine would be installed with butterfly isolation valves. The bifurcation to supply the second 4-MW unit would be blocked with a blind flange until that turbine is installed.

The penstock would be a steel pipe 3.75 m in diameter with a pipe wall thickness of 11 millimetres (mm). The length of the penstock would be approximately 355 m and would be supported intermittently with concrete saddles. The by-pass valve and related equipment were sized for a flow of 42 cubic metres per second. Energy from the by-pass system would be dissipated with a hollow-jet cone valve discharging into the stilling basin. The dissipation valve would discharge below the water line and would be designed to operate automatically in the event of unit shutdown.

The average annual energy output for the 10-MW facility was estimated to be 60.18 gigawatt hours (GW.h), excluding generator and turbine losses. Actual output would be less, but Canadian Hydro stated that its two-unit design would capture 75 per cent of the theoretically available energy.

Canadian Hydro computed its energy estimates using average yearly flows and reservoir levels. It acknowledged that this method tends to overestimate energy output. If historical data over the last 60 years had been used to calculate energy for each year, the average annual energy would be somewhat lower. According to the Canadian Hydro estimates, a 6-MW plant would capture 56 per cent of the available energy at the site, and the total 10-MW plant would capture 71 per cent of the available energy.



LEGEND



- New construction

FIGURE 2: GENERAL LAYOUT OF PROPOSED PLANTS
Applications No. 881550, 881838, 890529
Dickson Dam Power Plant

Canadian Hydro stated that its plant would be operated by a trained technician who would be at the plant 8 hours per day and 5 days per week. Other operating personnel would be on call 24 hours per day.

Canadian Hydro proposed to connect the 6-MW plant to TransAlta's existing 25-kV distribution system in the region. It maintained that this could be accomplished without any reconductoring of the existing distribution circuit. It recognized that the addition of the 4-MW unit would require reconductoring of 18 km of existing distribution circuit to the Innisfail substation. Canadian Hydro stated it was willing to upgrade the line for the 6-MW plant if required.

Canadian Hydro estimated the capital cost for the 6-MW facility at \$9.5 million (1990 dollars) and the 10-MW facility at \$14.27 million. Approximately 55 per cent of this would likely be spent in Alberta. The annual operating costs were projected to be \$440 000 and \$600 000 (1991 dollars) for the 6- and 10-MW facility, respectively.

Canadian Hydro presented several financial and economic analyses to support its application. One such analysis showed that the internal rate of return for both the 6-MW and 10-MW facilities would be acceptable from a private developer's perspective. In another analysis Canadian Hydro indicated that, of the three private proponents, its design resulted in the highest annual benefit. Canadian Hydro also presented an analysis showing that, for installations over 10.5 MW, the incremental cost per megawatt exceeded the incremental revenue, implying no installation over this size was economic.

Canadian Hydro said its project would likely be financed on the basis of 80 per cent conventional debt and 20 per cent equity, although the ultimate debt/equity structure could change pending the finalization of project details. Financial resources and backing would be provided by its parent company, Oilco Resources, of the Petrol Group of Companies.

Oilco Resources Ltd. is a Calgary-based Canadian controlled junior oil and gas company which was formed in mid-1987 and commenced operations in the beginning of 1988. In slightly more than a year, Oilco has successfully invested approximately \$1.6 million and has an appraised value of \$3.5 million. Oilco is affiliated with the Petrol Properties Ltd., which provides advantages such as access to capital, marketing expertise, financial systems support, and specialized geological and engineering staff. Companies within the Petrol Group are principally in the business of oil and gas but also extend to manufacturing and real estate construction, sales and property management.

Canadian Hydro stated that its venture partner, UMA Engineering (UMA), would provide half of the equity financing required. As proof of financing, Canadian Hydro presented a firm offer made by the Royal Bank to finance up to \$7.6 million for a 6-MW facility. As further proof of

financial capability, Canadian Hydro submitted a letter from Petrol Properties indicating financial support and capability as well as a letter from the Mutual Life Company of Canada indicating an interest in financing a 6-MW plant.

Canadian Hydro noted that in preparing its application it had assembled an experienced project team including some key UMA personnel who had been involved in the design and construction of the Dickson Dam itself. This previous experience assured that the facility would be developed appropriately - particularly in terms of dealing with the geological and geotechnical implications of the project.

3.2 Independent Producer Power, Inc.

Independent Producer proposed a two-unit powerhouse, structurally independent of the tunnel outlet and located downstream in the stilling basin, generally as shown in Figure 2. A mobile crane would be used for equipment maintenance. Therefore, the powerhouse would not be equipped with a permanent crane. Prior to start-up of construction, the stilling basin would be dewatered through use of a timber crib cofferdam with rock and gravel fill. Independent Producer anticipated a construction period of approximately 20 months, with plant completion in early 1992.

Independent Producer stressed that it proposed to install world-class machines, pointing out several advantages inherent in its project design. For example, the cofferdam's design would allow an increase in its height in case of a sudden rise in the level of tail water during construction.

Independent Producer proposed installing two identical vertical Kaplan turbines coupled to two synchronous generators. Each generating unit would have a rating of 6.4 MW at a 32-m net head. Two identical units would avoid the disadvantage of a larger single unit operating at reduced efficiency during periods of reduced rates of flow. Independent Producer did note, however, that the reduction in minimum flow releases, from 16 to 8 cubic metres per second, is considered a long-term goal of Alberta Environment and not likely to occur in the early operating years of the hydroelectric facility.

Independent Producer proposed to install a steel penstock with a diameter of 4.0 m. The penstock would be inserted into the existing tunnel in sections, transported into position on rail tracks, and welded in place. The rail tracks would ultimately be embedded in concrete to form the support for the penstock.

The by-pass system would consist of three or more pipes to divert tunnel flow into the stilling basin in case of turbine shutdown, and would be sized for a full flow of 42 cubic metres per second. The by-pass valves would be motorized, designed for remote operation, and would discharge above water level. Independent Producer proposed using blind flanges instead of butterfly valves to provide for turbine isolation. It was estimated that this isolation procedure would require about 24-36 hours.

Independent Producer stated that its hydraulic system would be designed to withstand 50 per cent overpressure and a 45-m static head.

Independent Producer estimated the energy produced annually by its 12.8-MW facility would be 59.6 GW.h - approximately 75 per cent of the maximum energy of 80 GW.h available at the site. Its two-unit configuration would allow one unit to be shut down during low winter flows, while the other unit would operate at a high capacity factor, as much as 88 per cent. Independent Producer estimated its plant output would be 61.3 GW.h if the low flow suggested by Alberta Environment were to happen.

Independent Producer stated that its energy studies were based on very detailed and exhaustive hydrological records from 1912 to 1979 and on actual flow data from 1980 and 1988. The theoretical maximum energy was computed on a month-by-month basis over a 70-year period and then averaged to obtain an annual estimate.

Independent Producer proposed connecting its facility to TransAlta's existing Innisfail electric substation via an 18-km dedicated 25-kV line. This dedicated 25-kV line, which would follow a different route from TransAlta's existing 25-kV distribution line, would minimize TransAlta's concerns about technical matters, and would eliminate potential problems for customers. The dedicated line would be built on structures that TransAlta could use later to string an additional line to supply future load growth.

Although Independent Producer would build the dedicated line, it would prefer that TransAlta own and operate the line. It noted that its alternative routing was acceptable to the Rural Electrification Areas, the County of Red Deer, and Alberta Government Telephones. The plant switchyard would be located adjacent to the powerhouse on the right bank of the river and would contain one 15-MVA, 3-phase transformer. To preserve the aesthetic environment, Independent Producer would be prepared to construct an underground powerline in the vicinity of the dam. These costs have been included in the project cost.

Independent Producer estimated the total cost for its project at \$17.4 million (1990 dollars), of which some 65 per cent would likely be spent in Alberta. The annual operating costs were estimated to be \$400 000 (1991 dollars). Its cost estimates were based on actual quotations from suppliers and actual engineering design. The Canadian

Electrical Association's costing methodology was used only as a check. Independent Producer's capital cost estimate did not include an allowance for interest during construction. However, this exclusion would be offset by an "overestimation" of approximately \$1 million in the estimates for development, engineering, and financing.

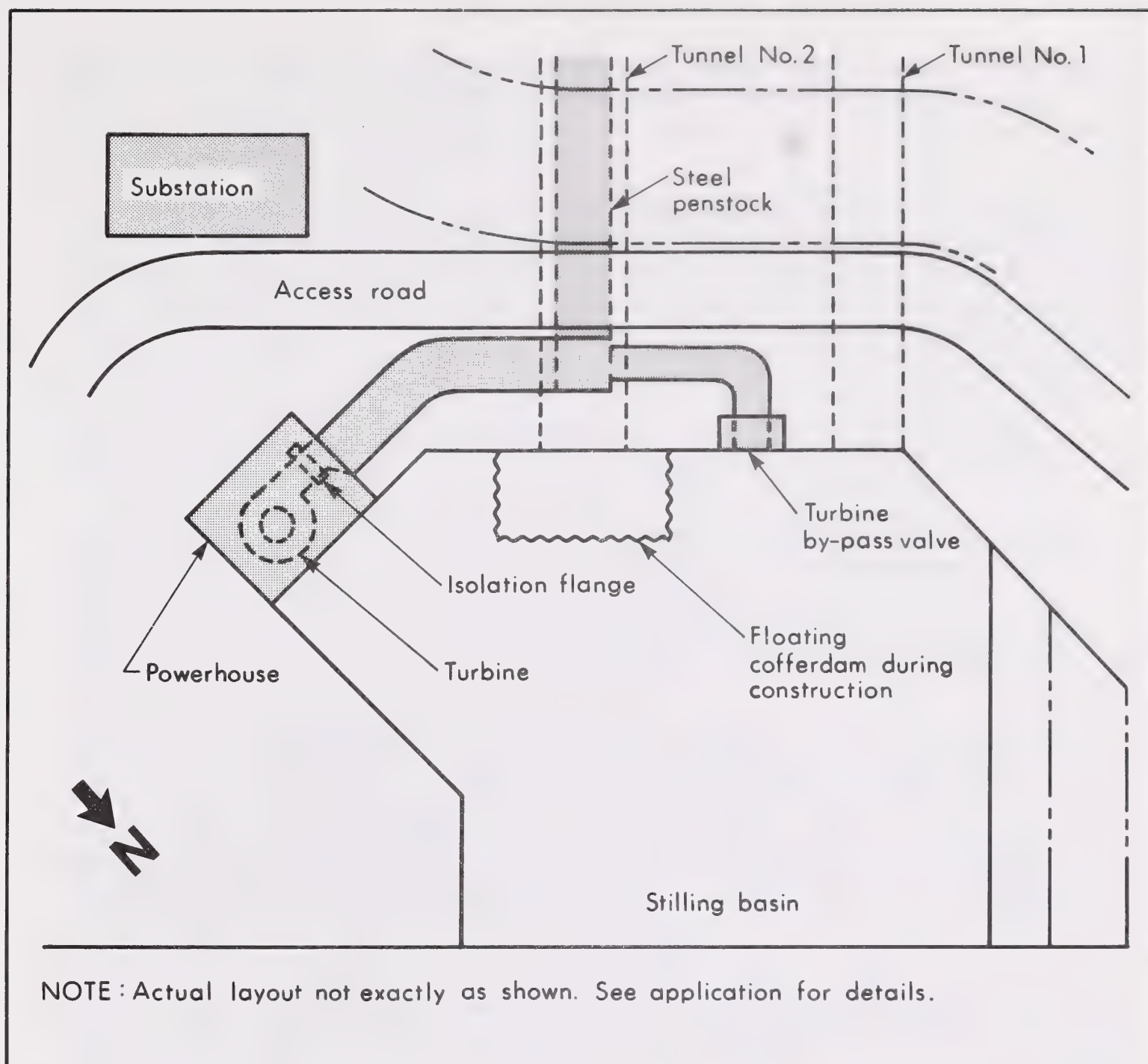
Independent Producer's feasibility studies indicated that the optimum plant size should be between 10 and 15 MW. Its final choice of size was based on the philosophy of harnessing the maximum amount of energy that would be financible, ie, to get the maximum use of the hydro resource while maintaining economic viability. It tested its project, assuming a capital cost of \$16.5 million, using four syndication models developed by financial experts. These tests demonstrated that the project was financible in all four models. Even when capital costs were increased to \$17.5 million, the project remained financible in all models. However, when capital costs were increased to about \$18.5 to \$19 million, only two models indicated that financing was still possible. With capital costs in the range of \$19 to \$20 million, financing was still possible but very marginal. Independent Producer also noted that syndicated financing can cost up to 7 or 8 per cent of the capital being raised. Allowance for this had not been included in its projected cost. Independent Producer had not yet secured financing, intending to seek it upon being awarded the project. It expressed confidence that the project could be financed and developed along the lines it had proposed.

3.3 Dickson Power Ltd.

Dickson Power proposed a powerhouse consisting of a single 10-MW turbine-generator set, to be located on the right bank of the stilling basin, adjacent to Tunnel No. 2, as shown in Figure 3. This choice of location for the powerhouse would minimize construction costs and disturbance in the stilling basin. Other stated benefits of this location are ease of plant expansion and ease of removal of plant facilities upon decommissioning. Dickson Power stated that, because the dam has been constructed and the basin flooded, building the powerhouse in the stilling basin, as the others have proposed, would not be the best way to develop the site. It proposes to use a floating cofferdam to dewater only the exit of Tunnel No. 2, and not the entire stilling basin, to facilitate installation of the penstock pipes.

Dickson Power scheduled a completion date of October 1991 and an 18-month construction period. This schedule was planned to minimize water turbidity during construction and to comply with Alberta Fish and Wildlife requirements.

Dickson Power proposed installing one Kaplan turbine and a synchronous generator with a 10-MW rating at a net head of 32 m. Its choice of a single 10-MW unit was based on an annual cost/benefit analysis of the various unit sizes that would be financible. However, if future water-flow releases were to be reduced below 16 cubic metres per second - a



LEGEND

 - New construction

FIGURE 3: GENERAL LAYOUT OF PROPOSED PLANT
Application No. 881989
Dickson Dam Power Plant

possibility that was suggested by Alberta Environment - the installation of two 5-MW generators would be considered. However, Dickson Power noted that Alberta Environment had not defined the probability or timing of such possible future flow changes.

The penstock pipe proposed by Dickson Power would be 3.6 m in diameter and some 350 m in length, supported inside the tunnel by intermittent saddles. The penstock would be connected with steel couplings, allowing for some degree of flexibility in the alignment of the penstock pipe. These couplings would make the penstock easier to install, maintain, and remove, and would avoid the need to weld the penstock sections inside the tunnel. The penstock would exit the tunnel and run on the surface to the powerhouse. This surface portion of the penstock would be supported by a concrete case. Dickson Power proposed blind flanges, instead of butterfly valves, to provide for turbine isolation.

The penstock would be provided with a motorized by-pass system with remote operating capability in the dam control building, if required. The by-pass would include a single elevated hollow-jet energy dissipation valve, which would discharge above the water level in the stilling basin. The valve would be designed to operate automatically should the generating unit be shut down.

Dickson Power estimated an average annual energy output of 52.9 GW.h from its proposed single 10-MW generating unit under normal flow conditions. It did not provide an energy estimate for the case of reduced water-flow releases since, in its opinion, Alberta Environment had not defined the probability or timing of possible flow changes. Dickson Power admitted that the head losses inherent in its particular penstock design would reduce the energy output of the plant. However, Dickson Power also stated that its proposal was the only one with provisions for availability of operating personnel 7 days a week, 24 hours a day. This feature would make the total annual energy output higher than the output of a similar but unattended or partially attended plant because of the prompt response time in the event of unanticipated problems.

Dickson Power proposed to connect its facility to TransAlta's existing 25-kV distribution system, in accordance with TransAlta's connection scheme and costs. This scheme requires upgrading of the line by reconductoring approximately 18.3 km of the existing line and upgrading the protection on the line and at the Innisfail substation. Dickson Power stated the following advantages in connecting its facility to the existing 25-kV line:

- (1) the reconductoring would result in a decrease in line losses;
- (2) the generator would provide voltage regulation for the region, thereby negating the need for the voltage regulator currently in place; and
- (3) connecting to the existing line would not require additional ERCB approval and would require only minimal additional right of way.

Dickson Power estimated the total cost of its project at \$14.4 million (1991 dollars), some 65 per cent of which would be spent in Alberta. It estimated annual operating costs of about \$516 000 (1991 dollars). Dickson Power used actual budget quotations for over 50 per cent of its direct project costs and a well-known costing method for the remaining 50 per cent. It noted that locating the powerhouse off the stilling basin would avoid the use of an expensive cofferdam, resulting in lower construction and demolition costs. Dickson Power presented several cost/benefit analyses for a variety of unit sizes. It used these to arrive at 10 MW as the optimum size for the Dickson Dam site.

Powerx Energy Corporation (Powerx) has committed to provide 100 per cent financing for the project, although Dickson Power would retain control over the construction and operation of the facility. Dickson Power submitted that it is the only applicant with financing committed for both the detailed design and the construction of its project, without any further negotiations.

3.4 The Special Areas Board

The Special Areas Board proposed constructing a reinforced concrete and structural steel powerhouse in the stilling basin downstream from the end of Tunnel No. 2, totally separate from all existing structures, generally as shown in Figure 2. Or, subject to Alberta Environment's consent, it could build the powerhouse adjacent to the end of Tunnel No. 2, thereby reducing construction costs.

Dewatering of the stilling basin would be accomplished with a two-stage cellular timber crib cofferdam. The cofferdam would be built higher than that proposed by the other applicants to ensure sufficient weight to prevent sliding of the cofferdam. The powerhouse would contain a permanent overhead bridge crane that would be used during construction for the installation of equipment inside the powerhouse and for maintenance thereafter.

The Special Areas Board proposed installing two vertical-shaft Kaplan turbines and two synchronous generators. Each unit would have a rated capacity of 7.45 MW at a net head of 29 m. Butterfly shut-off valves would provide isolation of the generating units from the penstock.

The Special Areas Board proposed a penstock pipe 4 m in diameter, with a wall thickness of 12 mm, and approximately 300 m in length. The penstock would be supported by a continuous concrete bed running from the tunnel's main gate shaft to the end of the tunnel. The penstock bifurcation piece at the exit of the tunnel would also be encased in concrete.

The proposed by-pass structure would be rated at a maximum of 19 cubic metres per second. It would consist of a pipe 1.2 m in diameter, branching from the penstock to a free-discharging cone valve 1 m in diameter. This valve would operate independently of the turbine.

The Special Areas Board stated that its plant would be designed for remote control as well as for automatic shutdown. Furthermore, it designed its plant and equipment to a utility standard with a life expectancy of 70 years or more.

The Special Areas Board estimated an average annual production of 63.8 GW.h, assuming a particular reduced winter flow (scenario ODO5 as identified by Alberta Environment). It stated that any changes in future flows would have little effect on the plant's annual production because the larger plant size would allow it to capture higher summer flows. It further stated that its plant would capture 81 per cent of the regulated flow of the river.

The Special Areas Board proposed connecting its plant to TransAlta's existing Innisfail substation via a 25-km 138-kV line running east from the plant site. It was also willing to explore with TransAlta the possibility of building a 25-kV dedicated line to Innisfail substation, instead of the 138-kV line.

The Special Areas Board estimated total project costs of \$36 million (1992 dollars). Approximately 65 to 70 per cent of the capital cost would be expected to be spent in Alberta. Annual operating costs, including a grant in lieu of taxes, were estimated at \$478 000 (1989 dollars). The Special Areas Board suggested that its cost estimate is realistic and comparable to the costs of similar projects in North America. It stated that its engineering and cost estimates were significantly advanced compared to the other projects, and that it considered as sufficient a 10 per cent contingency to cover unforeseen circumstances.

The Special Areas Board also provided a net present value analysis for its project using various assumptions. This analysis indicated positive values over the project's lifetime and implied rates of return that were acceptable to the Special Areas Board. It also performed a cash-flow analysis for what it considered to be a worst-case scenario and the cash flows were positive in each year after start-up.

The Special Areas Board's approach was to design a facility for optimal resource use and then to determine the reasonableness of the cost, rather than designing a project focusing only on financibility. It argued that any discussion of the return on publicly funded projects must recognize that many benefits might not be direct and/or financial. Furthermore, the fact that a project does not generate a return sufficient for private investors does not mean the project is uneconomic.

The Special Areas Board carried out a net present value analysis to compare the relative economics of various unit sizes. This provided the basis for its choice of plant size. The project would be financed through 50 per cent debt and 50 per cent equity. The latter would consist of capital from the Special Areas Board's reserve funds. The

remainder would likely be financed through a loan from the Municipal Finance Corporation. The Special Areas Board indicated that the proposed hydroelectric facility at Dickson Dam would be an integral part of a long-term drought-proofing scheme for the Special Areas. The revenue from the sale of the electricity would offset the operating costs of a planned water pumping facility. It emphasized that secondary benefits from drought proofing would more than offset the low returns that may be generated by power production.

4 ISSUES RAISED AT THE HEARING

Each of the applicants presented detailed evidence regarding its own project and also commented upon and questioned the evidence submitted by others. Some of the other interveners also questioned the evidence of the applicants. This section summarizes issues raised by interveners regarding each of the projects on the following subjects:

- technical matters
- connection with TransAlta Utilities Corporation
- total project cost estimates
- energy production
- optimum size and economic viability
- proponents' abilities to finance and complete project
- consistency with the Small Power Research and Development Act
- other matters

4.1 Technical Matters

4.1.1 Canadian Hydro Developers, Inc.

Independent Producer commented that the construction of a two-unit powerhouse with the initial installation of only one unit might create problems with stability of the powerhouse structure.

The Special Areas Board expressed some concern regarding the stability of Canadian Hydro's powerhouse. In its opinion, the powerhouse appeared to lack sufficient structural concrete.

All of the other applicants noted that the discharge from Canadian Hydro's proposed underwater energy dissipation valve might result in scouring and turbulence in the stilling basin.

4.1.2 Independent Producer Power, Inc.

Dickson Power asserted that the by-pass system proposed by Independent Producer would exhibit very high flow velocities and might cause a water hammer hazard.

4.1.3 Dickson Power Ltd.

Dickson Power stated that because the Dickson Dam is already built and the basin already flooded, building the powerhouse in the stilling basin, as the others have proposed, would not be the best way to develop the site. It further stated that building the powerhouse on the river bank would reduce water turbidity during construction, thereby alleviating concerns identified by Alberta Fish and Wildlife. In its view, such would not be the case for the other applicants. Therefore, Dickson Power suggested that the environmental consequences from building the powerhouse in the stilling basin would eliminate the other applicants.

Canadian Hydro stated that the stilling basin would be the best location for the powerhouse from the viewpoints of cost, construction, and operation. It expressed reservations about Dickson Power's proposed development, describing it as lacking the simplicity of the projects proposed by the others. Canadian Hydro also noted that, while Dickson Power's design would site the powerhouse to avoid disturbing the stilling basin, the plan would nevertheless require a complex floating cofferdam as well as the construction of a gabion wall and a tailrace channel. Therefore, it would not totally avoid construction in the stilling basin.

Independent Producer expressed some concern about the use of a floating cofferdam. Both Independent Producer and the Special Areas Board noted that the location of the powerhouse might not be feasible because the bedrock might prevent the use of steel pilings for the powerhouse foundations. The Special Areas Board also stated that the by-pass-system energy dissipation valve would discharge above water level and might cause problems due to ice fog. Dickson Power stated that this concern was unfounded. Finally, both the Special Areas Board and Canadian Hydro considered the possibilities for expansion, cited by Dickson Power for its project, to be overstated.

4.1.4 Special Areas Board

The Special Areas Board submitted that its project was based on more detailed design considerations than the other projects. It argued that, because the other proposals were at a very preliminary level, their cost estimates were understated. This could result in an incentive to cut corners or construct below utility standards, thereby sacrificing safe and efficient practices in order to meet their required minimum rate of return.

In response to comments by others that its by-pass system did not meet Alberta Environment's conditions, the Special Areas Board explained that the system was sized at 19 cubic metres per second, on the assumption that only one unit would be out of service at any time. This, it stated, was discussed with and was acceptable to Alberta Environment.

Independent Producer noted that, while all of the plant features cited by the Special Areas Board were technically feasible, they were also expensive. Furthermore, the Special Areas Board was insensitive to the cost implications of various factors in its risk analysis. Independent Producer cited the height of the cofferdam as an example, which it stated appeared to be needlessly high relative to the existing structure of the tunnel outlet. The Special Areas Board disagreed with this assessment, stating that its cofferdam was sized for safety. Independent Producer also expressed some doubt that the design of the Special Areas Board project was as advanced and as well thought out as was claimed.

Dickson Power was of the opinion that the Special Areas Board's proposal was seriously oversized. Further, Special Areas Board's intention to encase the penstock in concrete was not justifiable because about one-third of the existing tunnel would then be covered with concrete, making it unavailable for inspection. Moreover, if for any reason the penstock had to be removed, a substantial amount of jack-hammering would be required.

4.2 Connection with TransAlta Utilities Corporation

The Dickson Dam is located within TransAlta's electric service area. Electrical service is provided to the existing dam facilities by a 25-kV distribution line from the Innisfail substation, as shown in Figure 4. A second 25-kV line also supplies loads in the vicinity of the dam. Pending development of the Caroline sour gas field, possible transmission development in the region may include a 138-kV line from the Benalto substation into the Sundre district to serve expanding area load, including the Dickson Dam. However, the earliest in-service date anticipated for such a line would be 1992.

TransAlta provided connection schemes and cost estimates for all of the applicants, as shown in Table 2. The applicants' own estimates for connection of their respective projects are also shown in the table.

TABLE 2
ESTIMATES OF INTERCONNECTION COSTS ('000s \$)

	Canadian Hydro		Independent Producer		Dickson Power	Special Areas Board
	6 MW	10 MW	25 kV	138 kV		
Application	100 (1990\$)	1000 (1990\$)	620 (1990\$)	1910 (1989\$)	704 (1986\$)	3400 (1989\$)
TransAlta	1000 (1989\$)	1000 (1989\$)	1500 (1990\$)	3400 (1989\$)	1000 (1989\$)	3400 (1989\$)

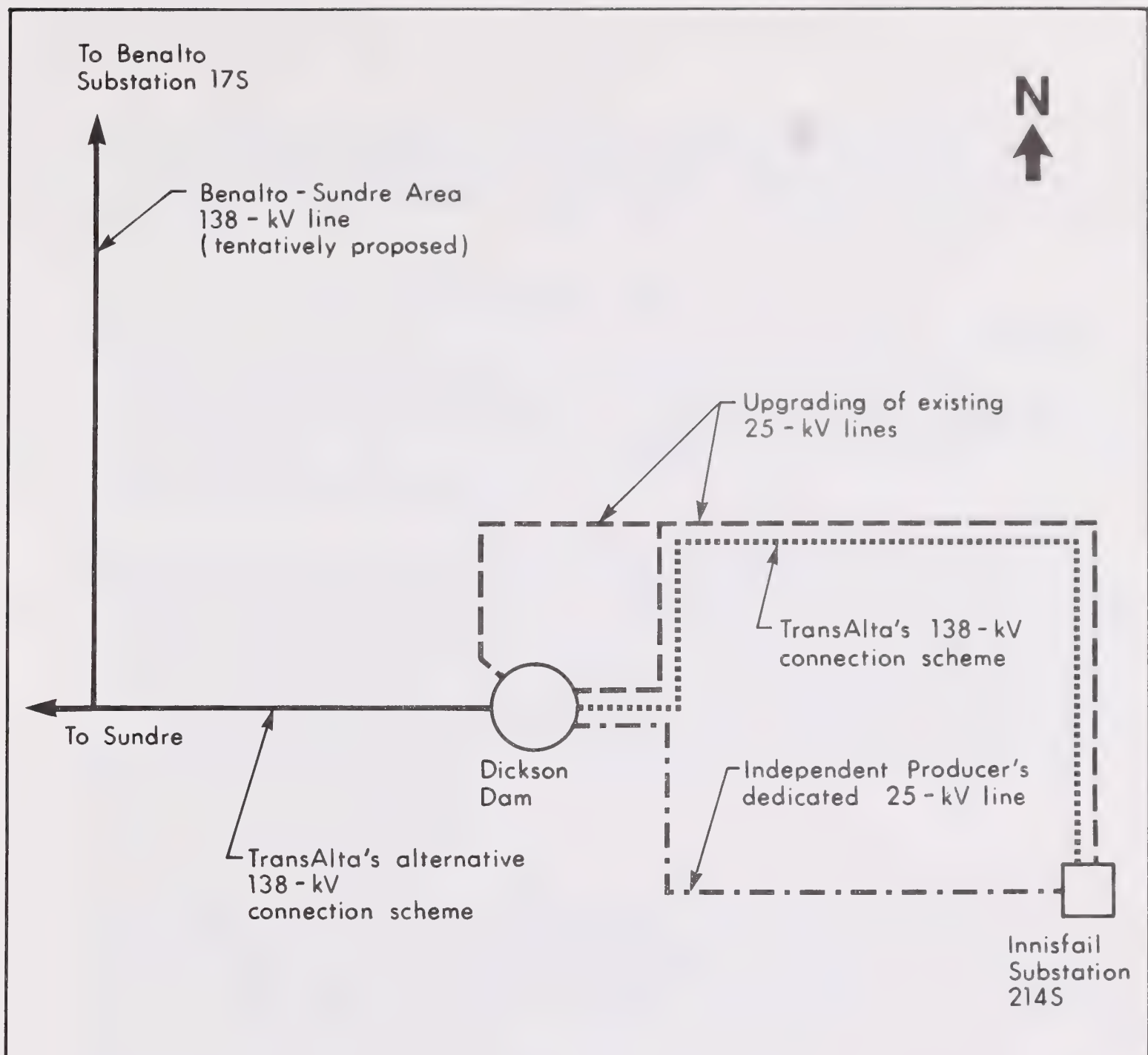


FIGURE 4 : ALTERNATIVE CONNECTION SCHEMES - DICKSON DAM
Applications No. 881550, 881838, 881989, 890529
Dickson Dam Power Plant

4.2.1 Canadian Hydro Developers, Inc.

Dickson Power stated that no evidence was presented to indicate that Canadian Hydro's 6-MW plant would not require reconductoring of TransAlta's distribution line. Independent Producer expressed some doubt about Canadian Hydro's estimate of the connection cost for the 6-MW plant.

4.2.2 Independent Producer Power, Inc.

Dickson Power stated that a dedicated line, as proposed by Independent Producer, would require 23 km of new power line right of way, necessitating further ERCB approval. It also noted that Independent Producer did not have a connection agreement in place with TransAlta and that it might be unable to negotiate one because of the large differences in their proposals.

The Special Areas Board noted that the cost estimates prepared by Independent Producer for both the 25-kV and the 138-kV lines were lower than those submitted by TransAlta. Independent Producer argued that it had used contractor costs which happen to be much lower than TransAlta's costs for the same job. It also stated that its estimate for the 25-kV line was based on a shorter route than the one estimated by TransAlta. Independent Producer stated that its 25-kV line route was acceptable to the region's Rural Electrification Association, to the County of Red Deer, and to AGT.

4.2.3 Dickson Power Ltd.

Independent Producer argued that Dickson Power did not address the matter of possible degradation of service to existing TransAlta customers (due to islanding and to problems of voltage and frequency control) which might occur when its plant is connected to the existing line. It also noted that there are many uncertainties regarding Dickson Power's connection scheme. Until TransAlta undertakes a detailed investigation, the level of generation that could be connected to the existing 25-kV line would remain uncertain.

4.2.4 Special Areas Board

The Special Areas Board accepted TransAlta's assessment that its project would require connection at a 138-kV level. However, it would select a more economical and technically feasible option, if one existed. The construction of a 25-kV dedicated line, as proposed by Independent Producer, could reduce connection costs.

Independent Producer argued that connection at the 138-kV level would be technically feasible but would be overkill. It stated that the Special Areas Board should have been more cost-conscious in searching for a more economical solution.

4.2.5 TransAlta Utilities Corporation

TransAlta indicated that connection of the 6-MW plant proposed by Canadian Hydro would require upgrading of the existing 25-kV line. Therefore, TransAlta's cost estimate for this connection was much higher than that estimated by Canadian Hydro.

TransAlta suggested that, on the basis of its preliminary observations, and given the limited data available on each of the proposals, a 138-kV connection would be appropriate for plants larger than 10 MW. However, a 10-MW limit for connection at the 25-kV level is a grey area and could change upon further investigation. Several concerns relating to connection to the existing 25-kV line must be addressed in the investigation, including matters such as voltage and frequency control, voltage flicker, and islanding. The cost of a 138-kV connection line to the Innisfail substation was estimated at \$3.4 million. Connection with a future 138-kV line in the Sundre-Caroline region, at a cost of \$2.25 million, might also be possible. TransAlta pointed out, however, that these estimates were "Order of Magnitude" only.

TransAlta presented an estimated cost for a dedicated 25-kV line. However, it stated that such a line might interfere with the orderly development of the local distribution system because of possible duplication of facilities. In any event, TransAlta suggested that insufficient information was presented at the hearing to allow the ERCB to make an informed decision with respect to the method of connection.

4.3 Total Project Cost Estimates

All parties submitted a great deal of evidence relating to the total cost of their respective projects. All applicants also questioned the costs submitted by the others and frequently suggested that the costs might be different from those stated by the respective proponents. The capital costs of all four projects, as estimated by the respective proponents, are shown in Table 3. The costs have been broken down into categories and, although some of the costs have been redistributed, the total project costs remain unchanged.

TABLE 3
PROJECT COSTS AS ESTIMATED BY APPLICANTS ('000s \$)

	Canadian Hydro		Independent Producer	Dickson Power	Special Areas Board
	6 MW	10 MW			
Mechanical Electrical	3377	5655	6800	4184	11553
Civil	2710	3160	4260	2280	10157
Switchyard Trans.	203	1205	1079	974	4630
Alberta Environment	1100	1100	1000	1130	1130
Indirect & Escalation Costs	2110	3150	4300	5823	8553
Total	9500 (1990\$)	14270 (1990\$)	17439 (1991\$)	14391 (1991\$)	36023 (1992\$)
Annual O&M & Expenses	440 (1991\$)	600 (1991\$)	400 (1991\$)	516 (1990\$)	478 (1993\$)

4.3.1 Canadian Hydro Developers, Inc.

Independent Producer claimed that Canadian Hydro derived its project costs using standardized cost curves. Canadian Hydro stressed that the prices for the penstock and turbines were quoted for this specific site and not derived from the Canadian Electrical Association costing manual. Furthermore, these costs had been reviewed by UMA and found to be reasonable. Canadian Hydro noted that its estimates are within 10 per cent of the estimates produced by Independent Producer. Independent Producer also stated that the installation of two dissimilar rather than identical units would result in relatively higher costs and, consequently, lower benefits.

Dickson Power noted that Canadian Hydro's cost estimates appeared reasonable, although some factors, such as the cofferdam and turbine by-pass systems, might have been underestimated.

The Special Areas Board argued that Canadian Hydro's estimate for the penstock appeared low, likely because an allowance for penstock bifurcation and transition might not have been included.

Canadian Hydro stated that its plant would be manned by a trained technician at the site 8 hours per day and 5 days per week. Dickson Power argued that Canadian Hydro had not allocated sufficient funds in its annual operating estimates to provide 24-hour operational response to Alberta Environment and TransAlta.

4.3.2 Independent Producer Power, Inc.

Canadian Hydro expressed some doubt as to the accuracy of Independent Producer's estimates, especially in view of the fact that its cost estimates were amended several times during and prior to the hearing. This indicated that Independent Producer's design is not as complete and fully costed as claimed.

Dickson Power argued that Independent Producer's total cost was significantly underestimated since the estimate did not include provision for a 138-kV line and the connection scheme suggested as appropriate by TransAlta, and did not include allowance for interest during construction. The cost estimate for the turbine by-pass was also low. Furthermore, Independent Producer's operating cost estimate was not sufficient to provide 24-hour operational response to Alberta Environment and TransAlta.

The Special Areas Board argued that Independent Producer's cost estimates were about \$6 million below those of the Special Areas Board's experts. The need to provide a 138-kV connection would further increase the cost of Independent Producer's project. Independent Producer disputed these arguments.

4.3.3 Dickson Power Ltd.

The Special Areas Board estimated the cost of Dickson Power's generating equipment to be higher than Dickson Power's own estimate.

Independent Producer stated that, if Dickson Power were to install two 5-MW units in place of the proposed single 10-MW unit, cost increases would likely result. It argued that, although Dickson Power said it might install two units, it did not present any detailed evidence to assess this potential increase in costs.

4.3.4 Special Areas Board

The Special Areas Board stated that its cost estimate is realistic and comparable with the costs of similar projects in North America. It further stated that its engineering and cost estimates are much more advanced than those for the other projects. It added that a 10 per cent contingency was considered sufficient to cover unforeseen circumstances.

Given the level of refinement, the Special Areas Board argued that a contingency of 25 per cent of project cost should be applied for the other three proposals. The Special Areas Board also stated that its civil works estimates were based on unit prices or in-house historical prices and were specific to the site. Major powerhouse equipment costs were on quotes from major manufacturers and the cost of auxiliary equipment was based on unit prices for similar hydro developments.

The Special Areas Board stated that its original design was based on the powerhouse being totally separate from the existing structure of the tunnel outlet. However, moving the powerhouse adjacent to the tunnel wall, if agreeable to Alberta Environment, could result in savings of as much as one million dollars. Finally, it stated that the penstock/by-pass piping costs were based on preliminary designs and detailed quotes from major mechanical contractors.

The Special Areas Board also stated that setting a conservative cost estimate was consistent with determining the real cost of proceeding with the project as planned, while understating costs was consistent with a primary interest in attracting the funds to proceed. The Special Areas Board would not have to cut corners or underdesign in order to complete its project. It argued that the other applicants had estimated their costs only in a very preliminary manner, seriously impairing their credibility. The Special Areas Board argued that the costs of the other three projects were either underestimated or the projects were not designed to the same utility standards as the Special Areas Board's proposal.

Dickson Power argued that the Special Areas Board annual operating costs were understated by at least \$300 000 because sufficient funds had not been allocated to cover county taxes and to provide 24-hour operational response to TransAlta and Alberta Environment. The Special Areas Board responded that it considered its annual operating costs accurate because its project had been designed for efficient operation, which would result in a lower cost of operation.

4.4 Energy Production

Each applicant presented an estimate of the annual production of energy from its respective project under the current operating conditions at the Dickson Dam. Independent Producer also presented estimates of annual production for all four projects, using some common assumptions. All of the estimates are presented in Table 4.

TABLE 4
ESTIMATES OF ANNUAL ENERGY PRODUCTION (GW.h)

As Made by	Canadian Hydro		Independent Producer	Dickson Power	Special Areas Board
	6 MW	10 MW			
Applicant	43.95	60.18	59.6	52.9	63.8
Independent Producer					
- 10-MW line restriction		52.5	NA	50.0	NA
- no line restriction		55.5	59.6	51.3	63.7
- low flow		51.9	61.3	48.4	65.4

4.4.1 Canadian Hydro Developers, Inc.

Dickson Power stated that Canadian Hydro's annual production was overestimated because its forecast was based on a power output exceeding the 115 per cent nameplate capacity that TransAlta might allow.

Independent Producer commented that UMA's estimate of the energy output appeared to overstate the output of the plant. Independent Producer estimated that Canadian Hydro's 10-MW facility would recover only 65.6 per cent of the maximum theoretically available energy, with plant capacity limited to 10-MW output. With no restriction on plant output, the energy recovery was estimated at 69.5 per cent. Furthermore, Independent Producer estimated production from the 10-MW plant at 51.9 GW.h with a future reduced flow. Independent Producer argued that Canadian Hydro appeared committed to building only a 6-MW plant, which would have an annual energy production of about 40 GW.h. This represents only a 50 per cent recovery of maximum theoretically available energy, with little evidence that the plant would be expanded to its full 10-MW size in the future.

4.4.2 Independent Producer Power, Inc.

Dickson Power questioned Independent Producer's estimate of energy production on the basis that it did not include transmission line losses. In Dickson Power's opinion, any proponent of a 25-kV dedicated line would have to bear the cost of such losses. Independent Producer estimated the line losses for its project would be approximately 2 per cent of energy output, but Dickson Power countered that, on average, they would likely be twice as much.

The Special Areas Board did not question Independent Producer's energy estimates but did note that the choice of blind flanges to provide turbine isolation, as proposed by Independent Producer, was an example of how long-term operating efficiency and energy production would be sacrificed to achieve savings in initial capital costs.

4.4.3 Dickson Power Ltd.

Dickson Power accepted the claims made by Canadian Hydro and Independent Producer that the additional bends in the penstock would result in additional energy losses. However, it countered that the additional energy losses would be offset by the absence of line losses when its plant was connected to the local 25-kV line, and by absence of any penstock bifurcation losses since it proposes a single-unit plant.

Canadian Hydro argued that a single 10-MW unit plant would be less reliable and would produce less energy than a two-unit plant of the same total capacity. It also noted that a single-unit plant would be less appropriate if the future flow releases from the dam were to be changed. Although Dickson Power had said it might consider installing a two-unit plant, Canadian Hydro suggested that the Board should consider only the information presented in the application.

Independent Producer questioned whether Dickson Power had carried out any energy studies for a two-unit plant or considered how efficiently the 10-MW unit would perform under lower winter flow. It stated that it had rejected a single-unit plant on the basis that such a plant could not operate for extended periods at flows as low as 8 cubic metres per second. Therefore, it concluded that Dickson Power's facility would also operate at lower efficiency, resulting in less resource recovery.

As it had done for Canadian Hydro, Independent Producer estimated the annual energy production for Dickson Power's facility as 50 GW.h with plant capacity limited to 10-MW output, and 51.3 GW.h with no restriction on plant output. Dickson Power argued that limiting the plant capacity in computing energy production would be inappropriate because its contract with TransAlta would allow generation up to 11.5 MW.

4.4.4 Special Areas Board

Independent Producer estimated the annual output of the Special Areas Board project as 63.7 GW.h, slightly lower than the 63.8 GW.h estimated by the Special Areas Board. Independent Producer further estimated the annual energy production to be 65.4 GW.h if winter flows were reduced. The Special Areas Board stated that it did not consider this estimate of its production accurate.

4.5 Optimum Size and Economic Viability

Each of the four applicants presented evidence as to the optimum size of facility that should be built at the Dickson Dam. The applicants defined the optimum size using a variety of different criteria. The applicants also presented various analyses showing the economic

viability of their respective projects in terms of such criteria as the internal rate of return or the net present value. These issues are discussed in the following section. The issue of the applicants' abilities to raise the funds required for their respective projects is dealt with in a subsequent section.

4.5.1 Canadian Hydro Developers, Inc.

Canadian Hydro stated that it optimized its proposed plant size using net annual benefit analysis. Independent Producer questioned Canadian Hydro's assumptions. Canadian Hydro presented another analysis showing that, of the three private proponents, the Canadian Hydro proposal resulted in the highest annual benefit. Canadian Hydro claimed its analysis showed that, for installations over 10.5 MW, the incremental cost per megawatt exceeded the incremental revenue generated, leading it to conclude that no installation over this size is economic.

Dickson Power stated that it is concerned that Canadian Hydro is not committed to developing the plant to the full 10-MW size. This concern was also expressed by both Independent Producer and the Special Areas Board. Independent Producer noted that Canadian Hydro claimed that the phased approach was used because initially TransAlta placed a limit on the maximum capacity that could be connected to the existing 25-kV system. Later, Canadian Hydro brought forward another reason for the phased approach - the possibility of future flow changes. Independent Producer also noted that Canadian Hydro was uncertain as to the timing of installing the second unit. The Special Areas Board noted that Canadian Hydro's optimization analysis was financial in nature rather than economic. Therefore, the expansion was dependent entirely on consideration of the financial return. The Special Areas Board argued that the phased approach or the construction of a plant of less than 10-MW size could not be justified and should not be allowed.

4.5.2 Independent Producer Power, Inc.

Using a variety of capital costs and revenue streams, Independent Producer submitted cash flow and internal rate of return analyses for its 12.8-MW plant to indicate that its proposed project is viable from a private developer's perspective. It claimed its feasibility studies indicated that the optimum plant size should be between 10 and 15 MW. Its final choice of size was based on the philosophy of harnessing the maximum amount of energy that would be financible; ie, maximizing use of the resource while maintaining economic viability. Independent Producer carried out similar analyses for the three privately proposed projects to determine the annual benefits that could be expected. These analyses showed that the Independent Producer project had the largest annual benefit. Independent Producer also suggested that if a similar analysis were carried out for the Special Areas Board project, the outcome would not change. Finally, Independent Producer argued that, for valid comparisons among the four projects, the capital and operating costs as well as the energy revenues must be evaluated on an equal basis.

Canadian Hydro noted that Independent Producer's original optimization analysis was based on a capital cost of \$12.9 million, which resulted in an optimum plant size of 12.8 MW. However, if the revised capital cost of \$17.4 million were used, the new optimum economic plant size would be smaller than that proposed by Independent Producer.

4.5.3 Dickson Power Ltd.

Independent Producer noted that Dickson Power's cost estimates used in the optimization analysis were derived from costing manuals, which Independent Producer did not consider appropriate. It argued that Dickson Power's plant size appeared to be based on TransAlta's position regarding the maximum size of facility that could be connected to the existing 25-kV line. Consequently, it was of the opinion that Dickson Power's proposal failed to optimize the full economic potential of the Dickson Dam site.

4.5.4 The Special Areas Board

The Special Areas Board conducted a net present value analysis which compared the relative economics of various sized plants and provided the basis for its choice of plant size. It noted that the method was intended to show the relative value of different plant sizes and not to reflect the financial benefit of the project. The Special Areas Board argued that the successful applicant should optimize the use of the resource and that true optimization had nothing to do with the rate of return, financibility, or assumed cost of financing, all of which the others used to determine their respective plant sizes. The Special Areas Board did not agree with Independent Producer's claim that "harnessing the maximum financible energy" implied "optimized resource development". It submitted that only the Special Areas Board provided true, comprehensive evidence in this regard.

The Special Areas Board stated that, rather than designing a project focusing only on financibility, its approach was to design a utility standard facility for optimal use of the resource and then to determine the reasonableness of the cost. In its view, any discussion of the return on publicly funded projects must recognize that many benefits might not be direct and/or financial. Furthermore, the fact that a project does not generate a return sufficient for private investors does not mean the project is uneconomic.

Independent Producer argued that the Special Areas Board project should be evaluated through a test of private financibility. The Special Areas Board disagreed, saying this did not provide an adequate test of feasibility, since there is no market for the "public goods" served by the Special Areas Board. Furthermore, its objective is not to minimize investment in order to maximize short-term returns, but rather to develop a long-term investment strategy to benefit Special Areas Board residents. The Special Areas Board's real need is to buffer future

energy costs by using energy from this plant for its drought-proofing scheme, and not a return on investment. It emphasized that the other objectives and benefits from the drought-proofing scheme should not be ignored in evaluating the desirability of the project.

Canadian Hydro claimed that the Special Areas Board's proposal was based on optimization studies that were largely revenue driven, since the capital cost was not expected to produce a return comparable to what the other projects must provide. It questioned whether this approach provided an optimum resource balance. Canadian Hydro argued that, taking into account a 70-year project life, the Special Areas Board's project would produce a return of less than 8 per cent, and a 15-year return of less than 2 per cent. Therefore, the Special Areas Board proposal was not an economically viable investment for the taxpayers of Alberta. Canadian Hydro argued that the Special Areas Board attempted to justify the project by relying on the downstream benefits of a water diversion project - benefits that were irrelevant for the purpose of evaluating this project. If the hydroelectric scheme were considered by itself, the annual revenues from the operation of the facility would produce a less than reasonable return on the Special Areas Board investment. Canadian Hydro further argued that the return on investment would be greater if invested elsewhere.

4.6 Proponents' Abilities to Finance and Complete Project

4.6.1 Canadian Hydro Developers, Inc.

Dickson Power did not consider Canadian Hydro to have the financial ability to proceed at this time. It also noted that Canadian Hydro was not proceeding with its other small hydro projects for which it had received ERCB approvals.

The Special Areas Board likewise noted that Canadian Hydro had not yet raised the funds necessary to proceed with any of its other approved small hydro projects. Furthermore, the Special Areas Board argued that Canadian Hydro would proceed at Dickson Dam only if further detailed design and costing established that it was economic to do so.

4.6.2 Independent Producer Power, Inc.

Canadian Hydro stated that Independent Producer's ability to finance might be marginal because of the uncertainty of its connection proposal and associated costs. Canadian Hydro further stated that Independent Producer had not presented any clear financing plan, but rather a range of possible financing schemes based on financial models. Canadian Hydro raised doubts as to whether Independent Producer would be successful in obtaining financing as suggested.

Dickson Power, stating that Independent Producer did not have the financial capability to proceed with its project, noted Independent Producer's own testimony that its project could not be privately

financed with a 138-kV connection, or even with a dedicated 25-kV line at the cost estimated by TransAlta. Dickson Power also noted that realistic indirect project costs would jeopardize the financibility of the project.

4.6.3 Dickson Power Ltd.

The Special Areas Board noted that Dickson Power's commitment from Powerx is clearly conditional upon final capital costs, and that its analysis showed Dickson Power's cost estimates might be inadequate. Furthermore, Dickson Power failed to disclose other relevant financial details.

4.6.4 The Special Areas Board

The Special Areas Board said that the ERCB should not grant approval for a project whose proponents do not have financial ability to complete and operate the facility. Failure to complete the project would result in a risk of the Dickson Dam site not being developed, and such a risk was unnecessary and undesirable. It further noted that some of the Alberta Environment conditions, especially the right to termination, would be difficult or impossible for a private financier to accept. This highlighted the inevitable conflict that would arise between private and public use of the Dickson Dam site. No such conflict would exist between the Special Areas Board and Alberta Environment because they are both arms of the same government.

The Special Areas Board also stated that it had the mandate and firmly established financial ability to complete its project, and that it is the only proponent that had guaranteed funding. It further stated that the other applicants offered no firm evidence of an unconditional financing commitment of any type. The Special Areas Board raised doubt that the other proponents would be able to proceed, since they all agreed that further refining of the cost estimates would be required prior to any financial commitment being made available to them. The Special Areas Board further noted that all the other proponents admitted lacking assets, and their respective projects would be financed solely on the rate of return acceptable to the respective financing parties, which are all likely to be outside the province.

Dickson Power said that the Special Areas Board Ministerial Order, which was made without discussion of any economic alternatives or effects, was being used to commit nearly the entire liquid assets of the Special Areas Board to an uneconomic power project. Dickson Power doubted the availability of a Municipal Finance Corporation loan to the Special Areas Board and did not think that the Special Areas Board had the ability to carry the project through to completion.

4.7 Consistency with the Small Power Research and Development Act

4.7.1 Canadian Hydro Developers, Inc.

Canadian Hydro stated that despite the Special Areas Board having received preliminary allocation of capacity under the SPR&D Program, the Special Areas Board proposal was not within the spirit and intent of the SPR&D Act. Canadian Hydro urged the ERCB to recognize that independent small power producers could not outspend government entities who apparently did not recognize that equity capital carried reasonable costs and who had access to lower-cost debt financing through government-funded programs.

4.7.2 Independent Producer Power, Inc.

Independent Producer stated that the intention of the Act was to encourage a small power industry in Alberta. These objectives could be met if any of the private projects were approved. It further stated that the Special Areas Board did not provide any indication of how its project would encourage small power. It questioned whether government-funded projects, engineered by a multi-national firm of engineers, would further the small power industry in Alberta.

Independent Producer noted that Canadian Hydro held several other approvals for small hydro projects under the Act. The information-gathering aspects of the Act would be furthered by allowing other entities and individuals to participate in the program.

Independent Producer also stated that one of the objectives of the Act was to minimize the risk to Alberta electric consumers in the event the proponent dishonoured the terms of the contract to sell its energy at the legislated price. It noted the claim by the Special Areas Board that a saving of 3 cents per kilowatt-hour would be realized by 2002 if the energy were to be wheeled to its pumphouse, rather than continue its contract with TransAlta to sell energy at the set price. Furthermore, it claimed that the Special Areas Board appeared to be seeking and relying on the possibility to "walk away" from the set price, as soon as wheeling energy might become advantageous to the Special Areas Board.

4.7.3 Dickson Power Ltd.

Dickson Power expressed the opinion that government bodies should not be competing with private developers under the Act. It also indicated that approving the Special Areas Board application would discourage the development of a small power industry.

4.7.4 The Special Areas Board

The Special Areas Board claimed that the Act did not exclude participation by government or municipal entities. Furthermore, the Act should not be interpreted as being aimed at the development of private industries, to the exclusion of public bodies with a genuine need for the power produced. It argued that the other proponents, who had no need for the power, did not properly fit within the spirit of the Act.

4.7.5 TransAlta Utilities Corporation

TransAlta indicated that it wished the ERCB to establish an operating life for the proposed power plants. This, it believed, would help the Minister of Transportation and Utilities in determining a contract length that would be appropriate for the sale of energy from the Dickson Dam power plant.

4.8 Other Matters

4.8.1 Dickson Power Ltd.

The Special Areas Board questioned the legality of the Dickson Power proposal in that Powerx would be a majority owner but would not be named in the approval. Granting approval to Dickson Power may be beyond the Board's jurisdiction since Powerx may not be subject to the Hydro and Electric Energy Act. Dickson Power responded that Powerx was incorporated in Alberta.

Dickson Power noted that it had been involved in preparing the draft of the power purchase contract with the Alberta Small Power Producers Association, Alberta Transportation and Utilities, and the utility companies, and that no other proponent had such involvement with these key groups.

4.8.2 The Special Areas Board

Canadian Hydro submitted that downstream benefits of the water diversion project of the Special Areas Board were irrelevant to the ERCB decision with respect to the benefits of the hydroelectric facility. Furthermore, this water project had not been approved or even applied for.

Dickson Power noted that the Special Areas Board might not even proceed with the project and that no clear connection between the hydro facility and the pumping scheme had been established, except for the transfer of revenues produced by the Dickson project. Furthermore, the ultimate destination of the revenues from the Dickson Dam hydro project did not relate to the purposes of the Hydro and Electric Energy Act.

Independent Producer said that, while the Special Areas Board might consider wheeling energy to a pumping scheme, this was stated only as a possibility and, therefore, was not a factor in the overall decision to pursue the hydro project. Furthermore, the purpose and intent of the Special Areas Board proposed development was one of raising revenue for offsetting pumping costs. The pumping scheme appeared to be at a very preliminary stage. Therefore, the ERCB should focus on whether society's scarce resources would be used efficiently at Dickson Dam. How the revenues from the project were to be ultimately used should be irrelevant to the decision.

The Special Areas Board was of the opinion that the public interest and the maximization of the public benefit should be the overriding factors considered. The individual characteristics of each project were important in this regard and these attributes should not be ignored. Therefore, the Board should not narrow the scope of its analysis solely to the hydroelectric facility when there was evidence that some broader public interest might be served. In the broader context, the benefits of the proposed pumping scheme should not be ignored. Moreover, Dickson Dam was built by Albertans for their own benefit. The use of this public asset by a private developer for profit would be acceptable only if there were no opportunity for public development of the hydro resource.

The Special Areas Board claimed that its project would directly and indirectly provide significant benefits to Special Areas Board residents and all Albertans through the pumping scheme, and no other applicant can make that claim. Furthermore, the other proponents would finance some or all of their requirements outside the province, so that much of the economic spinoff would be realized outside the province. But the benefit of the Special Areas Board proposal would remain largely in Alberta.

Independent Producer stated that there were considerable legal difficulties involved with the Special Areas Board proposal and its legal competence to engage in a power business that was outside the Special Areas. Dickson Power also questioned the legal status of the Special Areas Board to engage in the business of power generation.

The Special Areas Board noted that it would use the energy and/or revenue from the power project for a water-pumping scheme, but that the question of wheeling would be more properly handled by the Public Utilities Board. The Special Areas Board was not requesting a wheeling order from the ERCB.

4.8.3 Ducks Unlimited Canada

Ducks Unlimited noted that the generation of power from Dickson Dam was an integral part of the water stabilization scheme for the Special Areas. The water project would stabilize waterfowl habitat. It regarded the Special Areas Board proposal as an important initiative for wildlife in general.

4.8.4 Prairie Association for Water Management

The Prairie Association indicated that the Special Areas Board project would provide the energy required to drought-proof the area and provide a more stable supply of water of good quality.

4.8.5 TransAlta Utilities Corporation

TransAlta stated that an ERCB order directing the utility to wheel power generated from the Dickson Dam by the Special Areas Board would be inappropriate.

5 CRITERIA AND SELECTION OF THE PROJECT FOR APPROVAL

5.1 Criteria

The issue before the Board is which of the four applicants should be allowed to install and operate a small hydro power project at the Dickson Dam. The scope of the project is essentially the same for all the applicants, since it involves building a power plant at an existing dam site. The projects differ mainly in size, design, and method of financing. Moreover, the Board recognizes that all the proposals are at a preliminary stage of development and only the successful proposal would proceed to detailed engineering. This implies that the evidence presented by all the applicants regarding scale, design, and costs embodies an element of uncertainty, and the proposals are subject to changes during detailed design engineering.

The Board is satisfied that each of the applicants has the capability to design, construct, and operate its respective project. The Board is also satisfied that it would approve each of the applications if there were no other competing applications. It is therefore faced with the very difficult task of choosing among four proposals, each of which is similar in scope, subject to change during detailed design, and generally acceptable. This necessitates a selection of the most appropriate project or a ranking of the projects in terms of how well they would serve the public interest.

The Board has identified several criteria to assist it in choosing the most appropriate project. These are listed, not necessarily in order of importance, and discussed below:

- ability of the applicant to finance its project
- amount of energy produced
- efficiency in production of energy
- ability to handle altered rates of flow in future
- potential effects on the environment
- relative costs
- overall economic attractiveness

Ability of the Applicant to Finance Its Project

All four applicants appear to have pursued different financing schemes for their respective projects. The Board, however, recognizes that financing schemes are largely preliminary until detailed design has been carried out. Judgments regarding financibility of the projects may be speculative at this time but the Board is satisfied that the applicants would likely be able to finance their respective projects generally as described in their applications.

Since the financibility of a project cannot be determined until the final design is complete, and since all of the projects appear generally financible, the Board will set aside this factor from further consideration. It will approve the project which it believes is most appropriate, and provide time for the proponent to complete its design and put financing in place. If the financing cannot be completed, the Board would cancel the approval, and issue one to the next most worthy project.

Amount of Energy Produced

The Dickson Dam is operated to manage or regulate the flow of the Red Deer River. This dictates the flow regime that is available to any power plant that is developed at the site.

The Board believes that, other things being equal, a project that harnesses the maximum amount of energy at this site should be considered more favourably.

Efficiency in Production of Energy

Efficiency may be viewed as a relationship between the amount of energy produced and the resources used to produce that energy. The maximum producible amount of energy from the site may not necessarily be the most efficient if it requires an inordinate amount of resources to produce that energy. There is some optimum amount of capacity that can be installed efficiently, beyond which the cost of incremental capacity is more than the value of energy that would be produced. The Board believes that the public interest requires that efficiency be incorporated as part of the decision criteria.

Ability to Handle Altered Rates of Flow in Future

By letter dated 17 April 1989, Alberta Environment notified all the applicants regarding the conditions under which a power development would be allowed to proceed at Dickson Dam. One of these conditions concerns possible changes to future minimum water flows past the dam. The Board recognizes that, depending on the plant configuration, any reduction in minimum flow releases would have an effect on the amount of

energy production. It also believes that a two-unit plant would be less affected than a single-unit plant in the event that minimum flows were to be reduced in the future. Therefore, the plant configuration and its ability to recover more energy with altered rates of flow must be considered in the decision criteria.

Potential Effects on the Environment

If one project clearly had less impact on the environment compared to the other projects, then this factor would weigh in favour of such a project. However, none of the projects are expected to have a large impact on the environment, in part because the structure of the dam is already in place. Should two projects be comparable on other criteria, examination of their environmental effects could assist in the selection.

Relative Costs

The relative cost of each project and, more importantly, the direct benefits to be derived from that project are a major component of the public interest. The costs are tied to the efficiency criteria discussed above and are an inherent aspect of the determination of relative efficiency. The Board recognizes that the cost information provided by all the applicants is preliminary in nature, but believes that it is sufficiently representative of the intent of each proponent for it to be used for cost comparison.

Overall Economic Attractiveness

For the purposes of discussion in this report, it may be useful to distinguish between financial evaluation and economic evaluation. Financial analysis proceeds from the point of view of the private sector and includes all costs and benefits that have a direct effect on the sponsors of the project. Economic analysis is done from the point of view of the public sector and, similarly, includes those costs and benefits relevant to all of society. The types of costs and benefits relevant to each type of analysis may, and usually does, differ. For example, interest during construction is a cost that is relevant to the private developer but from the public viewpoint the real resources used are the same regardless of financing so interest is irrelevant to determining the "net" benefits of a project.

Economic evaluation attempts to include non-market costs and benefits such as increased reliability of electrical service and deferral of new generating plant, either by assigning some market value to them or through augmenting the economic analysis with a subjective judgment of the importance of such costs and benefits. Another way in which economic analysis differs from private financial analysis lies in how the future costs and benefits are taken into account.

To incorporate these criteria into its decision, the Board used the accepted approach of bringing all future values to the present through the application of appropriate discount rates to future costs and benefits. This allows comparison of projects as of one point in time - the present.

The rate at which future net benefits should be discounted may differ depending on whether the analyst has a private or a social point of view. A private developer may place a higher weight on net benefits realized quickly, since one of his objectives is to recover his investment as fast as possible. The social analyst, on the other hand, may place less emphasis on current benefits because he views benefits to future generations to be relatively more important than does the private developer.

The higher the discount rate the less weight is accorded to net benefits in future years. So, for example, a common real discount rate used in financial analysis would be in the order of 15 per cent whereas the discount factor appropriate for economic analysis of a government project might be closer to 5 per cent.

Choice of Primary and Secondary Criteria

The Small Power Research and Development Act (the Act) directs the Board not to consider whether a facility, applied for under the Act, is an economic source of electric energy in Alberta. Thus, if only one of the four projects under consideration had been applied for, the Board would have decided the application without reference to the economics of the project. However, the Board's mandate to ensure economic, orderly, and efficient development in the public interest requires it to consider the relative economic attractiveness of each proposal to choose one. Even if all of the projects appeared to the Board to be uneconomic, some would be relatively more attractive than others. The Board believes that economic attractiveness, in the broad sense described in the previous section, should be the primary criterion used in deciding among the projects. The use of this criterion will ensure the project chosen provides the optimum amount of capacity to produce energy as efficiently as possible. The economic criterion overrides that of private financial analysis since the project depends entirely on a public facility (Dickson Dam) to proceed and since the Act under which the project is enabled provides for pricing in excess of what the private marketplace would provide in order to accomplish its public-interest objectives.

The Board, therefore, will rank the projects on a preliminary basis according to economic attractiveness and then consider each project in turn to determine whether the other criteria have sufficient importance to alter the ranking.

5.2 Selection of the Project for Approval

Putting the Projects on a Comparable Basis

In order to evaluate the economic merits of the four proposals it is necessary to make some adjustments to the estimated project costs to permit a meaningful comparison. The Board believes that such adjustments should only be made where the evidence supports a change or to incorporate a consistent set of assumptions for purposes of comparison. Similarly, energy production estimates should be adjusted, as appropriate, for comparison of the economic attractiveness of the projects.

TABLE 5
DICKSON DAM POWER PROJECT
CASE COMPARISON

	NORMAL FLOW					LOW FLOW				
	CHD6	* CHD10	IPP	DP	SAB	CHD6	* CHD10	IPP	DP	SAB
Capacity (MW)	6.0	10.0	12.8	10.0	14.9	6.0	10.0	12.8	10.0	14.9
Energy (GW.h/yr)	42.1	56.4	59.0	52.7	63.7	39.3	55.7	60.9	51.0	65.4
Capital Cost (\$ Millions)	9.1	13.3	16.2	12.2	28.6	9.1	13.3	16.2	12.2	28.6
Net Present Value (\$ Millions)	7.4	8.2	8.2	8.5	(1.3)	5.8	7.4	9.3	7.5	(0.3)

* The analysis for CHD10 assumed construction of 6-MW plant initially and expanded 5 years later to 10 MW.

Legend: CHD6 - Canadian Hydro 6-MW plant
 CHD10 - Canadian Hydro 10-MW plant
 IPP - Independent Producer plant
 DP - Dickson Power plant
 SAB - Special Areas Board plant

The Board reasoned that because a 25-kV dedicated line is much less expensive than a 138-kV line, and because TransAlta's evidence suggests that it may be technically feasible to interconnect projects with capacities greater than 10 MW using a 25-kV dedicated line, Independent Producer and the Special Areas Board would likely choose this connection method. It would also appear that the costs of a new dedicated 25-kV line could be similar to that for an upgrade of the existing 25-kV line, and would be in the order of one million dollars. Accordingly, for cost comparison purposes, the Board adopted that as the connection cost for each of the projects. Adjustments were also made to engineering costs, contingency allowances, annual operating costs, and Alberta Environment's equity costs. Annual energy production estimates were adjusted, where appropriate, to account for energy losses in penstock pipe bends, the energy loss during plant shutdowns to accommodate blind flange insertion and removal, adjustments to turbine efficiency, and adjustments to generator output to account for line restriction. Based on these adjustments, the Board recalculated capital cost and annual energy production estimates which are shown in Table 5.

The Board notes that all the applicants expected the economic life of the projects to be in the range from 50 to 70 years. The Board considers this to be reasonable. Therefore, using the adjusted cost and energy estimates, it performed a 70-year net present value analysis in order to compare the relative economics of the projects. The results of this analysis are also shown in Table 5. The table shows net present value of all the projects for the normal (or current) flow scenario and for the low (or reduced) flow scenario. The net present value is expressed in real 1990 dollars at a discount rate of 5 per cent, and reflects the revenues deflated at 5 per cent during the contract life and held constant thereafter. Energy was priced at 5.2 cents per kW.h for the first 20 years of the project and 2.7 cents for the remaining economic life of the project.

The Board also carried out sensitivity analysis using other price regimes, including those recently announced by the provincial government. This did not change the ultimate conclusion or ranking of the above analysis.

Preliminary Ranking by Primary Criteria

The summary and comparison of all the projects is shown in Table 5. The Canadian Hydro 6-MW plant and the 10-MW plant have been shown as separate projects for comparison purposes. From the table, the projects can be ranked as follows, in terms of net present value:

<u>Rank</u>		<u>Normal Flow</u>		<u>Low Flow</u>	
	Project	\$10 ⁶ NPV	Project	\$10 ⁶ NPV	
1	Dickson Power	8.5	Independent Producer	9.3	
2	Independent Producer	8.2	Dickson Power	7.5	
3	Canadian Hydro (10)	8.2	Canadian Hydro (10)	7.4	
4	Canadian Hydro (6)	7.4	Canadian Hydro (6)	5.8	
5	Special Areas Board	(1.3)	Special Areas Board	(0.3)	

The Board notes that the preliminary nature of the design and cost of all the projects, as well as the calculated present values, do not provide a clear basis for deciding among the projects. Considering that the overall economic attractiveness is not the only relevant criterion, the Board believes it appropriate to make a further subjective review of each of the projects in turn.

Special Areas Board

The Board's economic evaluation of the Special Areas Board's application did not incorporate the costs and benefits of the water diversion and irrigation that was cited as a companion project. There were several reasons for the Board's approach which are set out below in increasing order of importance.

1. Sufficient information was not presented at the hearing to allow a formal evaluation of the companion project.
2. The Special Areas Board did not formally incorporate the companion project in its application.
3. The benefits of the power generation project that would insulate the Special Areas Board from future rate increases would be realized only if it became possible to wheel the energy produced to the irrigation project. However, there is a great deal of uncertainty as to if and when the wheeling might take place, whether or not wheeling is technically feasible, and the terms and conditions under which wheeling might be allowed.
4. Notwithstanding the difficulty of formally incorporating the companion project in its analysis, the Board considered whether it would be appropriate to consider that project subjectively and, if so, whether such subjective consideration would provide grounds for altering the ranking of the application of the Special Areas Board. The Board believes that it would be inappropriate to consider subsequent investment made possible by the generation project unless it did so for all the applicants, because any subsequent investment, or even consumption, based on the proceeds from the generation project will have a beneficial impact on the economy.

The Board notes that, although the Special Areas Board project would produce slightly more energy from the site than the other three projects, it would involve significantly greater investment to do so. This greater investment does not generate proportionally greater benefits and the proposed project is simply too large and costly to be economically attractive. In the Board's judgment, none of the other criteria can offset this weakness.

The Board, therefore, confirms the last place ranking of the Special Areas Board project.

Canadian Hydro

Canadian Hydro is proposing to install a 6-MW plant in the initial phase of the project and to add another 4-MW unit at a later date. While such a phased approach would have merit from the viewpoint of minimizing financial risk, the Board is concerned that there might be insufficient incentive to expand the plant to the 10-MW size at a later date. This is particularly true if a change in flow regime were to result in lower releases during the winter period and higher releases during the summer period. Whether or not expansion would take place would depend on the financial attractiveness of the expansion at some future date. It is not possible to say at this time what would happen, but the present value results shown in Table 5 at least raise the question of whether expansion would be attractive under all possible future flow regimes. Consequently, there is a probability that the site could be sterilized and its full potential might not be harnessed, if the 6-MW plant were not expanded.

The Board notes that the Canadian Hydro proposal is to build a 6-MW plant and to consider expansion to a 10-MW plant only if the flow regime is not altered. The Board also notes that it was generally acknowledged by all the parties at the hearing that there is a very high probability of a reduced winter flow scenario occurring. This further suggests expansion may not occur, and thus the ultimate energy recovered, as shown in Table 5, could be at least 20 per cent less than any other proposal.

Even if Canadian Hydro did expand, the present values are equal to or less than the Dickson Power and Independent Producer proposals, regardless of which flow case prevails. As expansion is delayed beyond the 5-year interval assumed in the Board's analysis, the net benefits are further reduced from those shown. This, coupled with the uncertainty regarding expansion and the lack of any significant advantage regarding other criteria, causes the Board to confirm its preliminary ranking of the Canadian Hydro proposal as the third best of the four projects.

Independent Producer and Dickson Power

The preliminary ranking of the remaining two proposals produced a somewhat ambiguous result, as reproduced below from Table 5.

<u>Rank</u>	<u>Normal Flow</u>		<u>Low Flow</u>	
	Project	\$10 ⁶ NPV	Project	\$10 ⁶ NPV
1	Dickson Power	8.5	Independent Producer	9.3
2	Independent Producer	8.2	Dickson Power	7.5

The Dickson Power proposal is marginally preferred (NPV 4 per cent greater) in the normal flow case whereas the Independent Producer proposal is preferred by a greater margin (NPV 24 per cent greater) in the low flow case. The Board also notes that the Independent Producer proposal in combination with the low-flow regime provides the highest net benefit available from the site. This is significant, in part because the probability that a low-flow regime will be imposed some time in the future is reasonably high.

The advantage of the Independent Producer proposal appears to derive from its choice of two units as opposed to one 10-MW unit as proposed by Dickson Power. Although Dickson Power indicated that it would be willing to investigate the installation of a two 5-MW unit plant, it did not actually amend its application to reflect this. Also, the cost of the facility would likely be greater than that used in the analysis. Therefore, in the comparisons that follow, the Board has assumed a single-unit installation for the Dickson Power proposal.

A two-unit plant offers greater reliability, higher operating efficiency, and greater flexibility in dealing with uncertainties in future flow regimes from the Dickson Dam. The Board believes that the ability to harness a greater amount of energy in an economic fashion under low-flow conditions should be an important element in judging the public interest. Given the condition imposed by Alberta Environment regarding the possibility of low flows during winter months, the Board also believes that option remains a real possibility in the future. The Independent Producer's project thus has a slight advantage in this regard.

There are distinct differences in the design of the two projects which have the potential to alter their relative impacts on the environment. Dickson Power would locate its power plant on the river bank rather than in the stilling basin as proposed by Independent Producer. Dickson Power would use a floating cofferdam in construction and would not have to dewater the entire stilling basin. The Board believes that the Dickson Power approach has the potential to be less disruptive to the environment, provided its design worked as planned. However, there is some question as to whether it would. The floating cofferdam would be complex and the Board is not aware of such an approach having been successfully used in a similar setting. If the design did not work, there would be delays and could even be a threat to safety. The Dickson Power project would involve a greater degree of staff attendance during plant operation, and thus would have a slight advantage in that respect.

Dickson Power's interconnection scheme was more readily acceptable to TransAlta. However, the Board believes that Independent Producer (or any other applicant) should be able to resolve the outstanding technical issues regarding its interconnection scheme, and so this would not be a major disadvantage.

In summary, the Board notes that both projects are technically and environmentally acceptable. Although each would have certain potential advantages over the other, on balance, they are very close. The two-unit plant of Independent Producer would be more flexible to deal with uncertainties in the future flow releases from the dam and would recover more energy in the event that minimum flow releases were to be reduced in the future. These advantages are sufficient, in the Board's view, to give Independent Producer a slight overall edge and a ranking of 1. The Dickson Power project would then be ranked as the second best of the four projects.

6 FINDINGS AND CONCLUSIONS

Applying the criteria discussed in the previous sections of this report, and using a ranking of 1 to indicate the most appropriate project to a ranking of 4 to indicate the least appropriate project, the Board finds that the applied-for projects can be ranked as follows:

Independent Producer Power, Inc.	-----	1
Dickson Power Ltd.	-----	2
Canadian Hydro Developers, Inc.	-----	3
The Special Areas Board	-----	4

Accordingly, the Board is prepared to issue an approval to Independent Producer for the construction and operation of its proposed power plant at the Dickson Dam site. The plant must be built essentially as described in the application and further discussed at the hearing. No major design changes or modifications would be allowed.

If, for whatever reason, Independent Producer is unable to put the financing in place and proceed with construction of its project within 12 months of the issuance of the approval, the Board believes that it should provide an opportunity to another applicant to develop the site. Should this event occur, the Board would cancel the approval issued to Independent Producer and issue an approval to the next ranked applicant, that being Dickson Power. Any such approval would be similarly conditioned. Similarly, approvals would be issued to the remaining applicants if, for whatever reason, the preceding approval holders were not able to proceed with their respective projects within 12 months.

Given that the economic life of all the proposals is expected to be in excess of 50 years, the Board believes that the contract term between the proponent and TransAlta for the sale of power should be the longest term permitted under the Act.

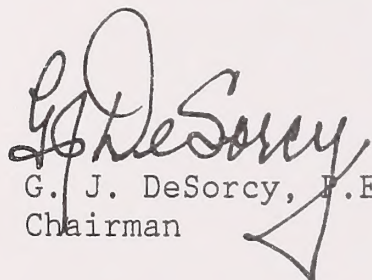
DECISION

Having considered all the evidence submitted in the applications and presented at the hearing by all the parties, and based on its own analysis, the Board has decided to approve the construction and operation of the 12.8-MW project proposed by Independent Producer, as described in its application. This approval is subject to the following conditions:

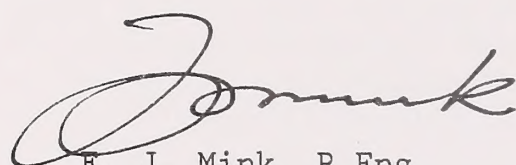
1. If Independent Producer is not able to satisfy the Board that financing is in place and construction has commenced within 12 months of the date of issuance of the approval, the approval will be cancelled and an approval will be issued to the next applicant in the ranking list shown on page 48 of this report.
2. The project must be built as described in the application and at the hearing. No major changes are to be made to the design of the project unless they are approved by the Board.
3. Final details of the project must be submitted for the approval of the Board prior to start-up of construction.

DATED at Calgary, Alberta, on 22 January 1990.

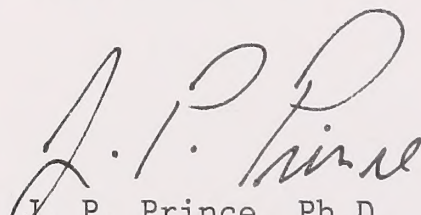
ENERGY RESOURCES CONSERVATION BOARD



G. J. DeSorcy, P.Eng.
Chairman



F. J. Mink, P.Eng.
Board Member



J. P. Prince, Ph.D.
Board Member

